

CLAIMS

1.           A magnetic memory comprising:  
            a substrate;  
            a lower portion structure provided on an  
5 upside of said substrate as a portion of a magnetic  
            element;  
            an upper portion structure provided on an  
upside of said lower portion structure of said  
magnetic element; and  
10           a sidewall insulating film provided to  
surround said upper portion structure of said magnetic  
element.
2.           The magnetic memory according to claim 1,  
15 wherein said magnetic element has a size of an outer  
circumference of said sidewall insulating film.
3.           The magnetic memory according to claim 1 or  
2, wherein said lower portion structure of said  
20 magnetic element comprises:  
            a conductive portion; and  
            a first magnetic film provided on an upside  
of said conductive portion, and  
            said upper portion structure of said magnetic  
25 element comprises:  
            an insulating film;  
            a second magnetic film provided on an upside

of said insulating film.

4.           The magnetic memory according to claim 1 or  
2, wherein said lower portion structure of said  
5 magnetic element comprises a conductive portion, and  
              said upper portion structure of said magnetic  
element comprises:  
              a first magnetic film;  
              an insulating film formed on an upside of  
10 said first magnetic film; and  
              a second magnetic film provided on an upside  
of said insulating film.

5.           The magnetic memory according to claim 3 or  
15 4, wherein said upper portion structure of said  
magnetic element further comprise:  
              a conductive film formed on an upside of said  
second magnetic film.

20 6.           The magnetic memory according to any of  
claims 1 to 5, wherein a plane shape of said upper  
portion structure of said magnetic element is any one  
of an oval, a cycloid, a rectangle, a hexagon, and a  
corner quadrangle.

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7.           The magnetic memory according to any of  
claims 1 to 6, wherein a distance  $d$  on a plane between

an outer circumference of an upper surface of said lower portion structure of said magnetic element and an outer circumference of an upper surface of said upper portion structure of said magnetic element has a  
5 relation of  $0.01 \text{ m} \leq d \leq 0.2 \text{ m}$ .

8. The magnetic memory according to any of claims 1 to 7, further comprising:

an interlayer insulating film formed to cover  
10 said lower portion structure of said magnetic element, said sidewall insulating film, and said upper portion structure of said magnetic element,

said interlayer insulating film has a via-hole on an upside of said upper portion structure of  
15 said magnetic element, and

said sidewall insulating film is formed of a material which has an etching selection ratio smaller than said interlayer insulating film.

20 9. The magnetic memory according to any of claims 1 to 7, further comprising:

an interlayer insulating film formed to cover said lower portion structure of said magnetic element and said sidewall insulating film, and

25 said sidewall insulating film is formed of a material which has a selection ratio in a chemical mechanical polishing or an etching-back smaller than

said interlayer insulating film.

10.       The magnetic memory according to any of  
claims 1 to 9, wherein said sidewall insulating film  
5 is formed of at least one of metal nitride, metal  
oxide, and metal carbide.

11.       The magnetic memory according to any of  
claims 1 to 10, wherein said sidewall insulating film  
10 comprises at least one of silicon oxide, silicon  
nitride, aluminum oxide, and aluminum nitride.

12.       A method of manufacturing a magnetic memory  
comprising:

15       forming a multi-layer film included in a  
magnetic element on an upside of a substrate;

          etching said multi-layer film into a  
predetermined pattern up to a predetermined depth, to  
form an upper portion structure of said magnetic

20 element;

          forming a sidewall insulating film to  
surround said upper portion structure of said magnetic  
element;

          etching said multi-layer film by using said  
25 sidewall insulting film and said upper portion  
structure of said magnetic element as a mask to form a  
lower portion structure of said magnetic element as a

remaining portion of said magnetic element.

13.       The method according to claim 12, wherein  
said lower portion structure of said magnetic element  
5 includes a conductive portion and a first magnetic  
layer formed on an upside of said conductive portion,  
and

          said upper portion structure of said magnetic  
element comprises an insulting layer and a second  
10 magnetic layer formed on an upside of said insulating  
layer.

14.       The method according to claim 12 or 13,  
wherein said etching said multi-layer film into a  
15 predetermined pattern, comprises:

          etching said multi-layer film into said  
predetermined pattern by using a physical etching.

15.       The method according to claim 14, wherein  
20 said physical etching is ion milling.

16.       The method according to any of claims 12 to  
15, wherein said lower portion structure of said  
magnetic element comprises a conductive portion, and  
25       said upper portion structure of said magnetic  
element comprises:

          a first magnetic layer;

an insulating layer formed on an upside of  
said first magnetic layer; and

a second magnetic layer formed on an upside  
of said insulating layer.

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17. The method according to claim 16, wherein  
said etching said multi-layer film is carried out by  
using a physical and chemical etching.

10 18. The method according to claim 16, wherein  
said physical and chemical etching is a reactive ion  
etching.

15 19. The method according to any of claims 12 to  
18, further comprising:

forming an interlayer insulating film to  
cover said lower portion structure of said magnetic  
element, said sidewall insulating film, and said upper  
portion structure of said magnetic element; and

20 forming a via-hole in said interlayer  
insulating film on an upside of said upper portion  
structure of said magnetic element by an etching  
method,

25 said sidewall insulating film is formed of a  
material which has an etching selection ratio smaller  
than said interlayer insulating film.

20. The method according to any of claims 12 to 19, further comprising:

forming an interlayer insulating film to cover said lower portion structure of said magnetic element, said sidewall insulating film, and said upper portion structure of said magnetic element; and

flattening said interlayer insulating film on an upside of said upper portion structure of said magnetic element by a chemical mechanical polishing method or an etching-back method,

said sidewall insulating film is formed of a material which has a selection ratio in the chemical mechanical polishing method or the etching-back method smaller than said interlayer insulating film.